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10 CFR § 50.73
L-2010-301

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555-0001

Re: Turkey Point Unit 3
Docket No. 50-250
Reportable Event: 2010-005-00
Date of Event: October 25 2010
Containment Liner Through Wall Defect
Due to Corrosion

The attached Licensee Event Report 05000250/2010-005-00 is being submitted pursuant to 10 CFR 50.73(a)(2)(ii)(A) due to a principal safety barrier being seriously degraded as well as 10 CFR 50.73(a)(2)(i)(B) for a condition prohibited by the Technical Specifications. If there are any questions, please call Mr. Robert Tomonto at 305-246-7327.

Very truly yours,

Michael Kiley
Vice President
Turkey Point Nuclear Plant

Attachment

cc: Regional Administrator, USNRC, Region II
Senior Resident Inspector, USNRC, Turkey Point Nuclear Plant

IE22
NRR

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resourse@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

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4. TITLE

Containment Liner Through Wall Defect Due to Corrosion

6. LER NUMBER						7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									Turkey Point Unit 4	05000251
10	25	2010	2010	- 005 -	00	12	22	2010	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

5

10. POWER LEVEL

0%

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☒ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Ronald Everett	305-246-6190

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	NH	LNR	B130	N					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On October 22, 2010, during the Unit 3 Cycle 25 Refueling Outage, containment liner plate degradation in the reactor pit area was detected during the ASME XI, IWE inspection. Augmented visual and ultrasonic examinations were performed. Thinning of the liner and twelve through wall holes (all in close proximity) were discovered. Design Features Technical Specification 5.2.1f requires a nominal thickness of the containment steel liner of 0.25 inches. This condition was reported to the NRC October 25, 2010 (Event number 46362) as a condition resulting in a serious degradation of the containment liner.

A liner plate section was replaced and inspected in accordance with the ASME Code. A root cause analysis was performed, including a metallurgical failure analysis. The root cause was determined to be failure of the coating system which was not designed for periodic immersion service. In order to prevent recurrence, the lower region of the reactor pit will have a coating system suitable for immersion applied. Previous boric acid inspections, ASME XI, subsection IWE, and Appendix J visual inspections did not detect this degradation. Actions have been identified to improve the liner inspection programs.

The root cause extent of condition analysis for this condition revealed that Unit 4 has had similar issues. A through wall hole about 1/16" in diameter was discovered November 25, 2006 in the Unit 4 reactor sump pit. The hole was evaluated as non-significant and repaired.

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NARRATIVE

DESCRIPTION OF THE EVENT

On October 22, 2010, during the Unit 3 Cycle 25 Refueling Outage, containment liner plate [NH, LNR] degradation in the reactor pit area was detected during the ASME XI, IWE inspection. Confirmation of the condition by augmented visual and ultrasonic examinations took until October 25, 2010. Thinning of the liner and twelve through wall holes (all in close proximity) were discovered. Design Features Technical Specification 5.2.1f requires a nominal thickness of the containment steel liner of 0.25 inches. This condition was reported to the NRC October 25, 2010 (Event number 46362) as a condition resulting in a serious degradation of the containment liner. A section measuring about 4" by 32" was replaced and inspected in accordance with the ASME XI Code.

CAUSE OF THE EVENT

A root cause analysis was performed of the Unit 3 condition, including a metallurgical failure analysis. The root cause was determined to be failure of the coating system which was not designed for periodic immersion service. Contributing causes included general and pitting corrosion resulting from periodic immersion in borated water (2,000 ppm) due to leakage past the reactor cavity seal ring and floor covers during refueling activities and transfer of large volumes of borated water from the upper reactor cavity to the reactor pit area (-15'8" el.). Other contributing causes included (a) poor housekeeping and cleaning of boric acid, and (b) boric acid inspections focused on pressurized borated systems and reactor bottom instrumentation. It was determined that (a) failure to include the reactor pit liner in the ASME XI, IWE program until 2005, (b) failure of the Appendix J program visual inspection procedure to include the reactor pit liner area, and (c) failure to include the reactor pit area in containment coatings walk downs performed every refueling outage contributed to the event. The extent of cause evaluation revealed the coating system was not designed for periodic immersion service.

During the root cause extent of condition analysis, it was noted that there was a failure to detect degradation resulting in a small hole about 1/16" in diameter in the Unit 4 reactor pit November 25, 2006. The hole was located in a localized corroded area about 1.5" diameter. Previous boric acid inspections, ASME XI, subsection IWE, and Appendix J visual inspections failed to detect coating failure. The hole in the Unit 4 liner was cleaned and plugged with a steel plug with a 2" diameter cap welded to the liner plate. Magnetic particle and visual examination of the weld was performed and a local leak rate test performed. An apparent cause evaluation of the Unit 4 condition was performed and documented the disposition of the condition.

ANALYSIS OF THE EVENT

The UFSAR, Section 5.1.1 states the reactor containment [NH] is designed so that any leakage of radioactive materials from the containment structure under conditions of pressure and temperature resulting from the largest credible energy release following a Loss of Coolant Accident (LOCA) will not result in undue risk to the health and safety of the public (1967 proposed General Design Criteria 49.) Design Features Technical Specification 5.2.1f requires a nominal thickness of the containment steel liner of 0.25 inches.

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The Unit 3 containment liner degradation detected was located in the reactor pit area (-15'8" el.) immediately adjacent to the concrete floor. Augmented visual and ultrasonic examinations revealed an area measuring approximately 3" x 36" with wall thickness measurements less than minimum wall, including through wall holes (all in close proximity). The total surface area of the perforations in the removed plate section measured approximately seven square inches. In order to restore full qualification of the liner plate, a section measuring 4" high x 32" long was replaced and inspected (magnetic particle inspections) in accordance with the ASME Code. A local leak rate test (LLRT) was performed following the repair. Additionally detailed visual (VT-1) inspections were also performed on the repair area both before and after the LLRT. Isolated areas adjacent to this section, were accepted by evaluation, in accordance with the ASME Code. The concrete floor was excavated adjacent to the vertical liner plate, 4 inches wide x 48" long x 4" deep to assess the depth of the degradation. Visual and ultrasonic exams revealed this region to be in very good condition. The ultrasonic results revealed all areas in contact with the concrete floor to be greater than 90% of the nominal wall thickness (0.25").

The initial phase of the Root Cause Evaluation (RCE) consisted of a metallurgical failure analysis. The degraded region of the vertical liner plate was cleaned to facilitate additional visual and ultrasonic exams. It was determined that the causative failure mechanisms were a combination of ID (air side) initiated general and pitting corrosion. Several through wall defects were visibly evident within the degraded region. The primary chemical constituent responsible for the corrosive attack was boric acid. The observed corrosion degradation likely initiated during the early years of plant operation and continued to occur over a period of many years, given the relatively low temperatures and associated corrosion rates in the reactor pit area. There was no evidence of corrosion degradation on the concrete side of the liner plate.

The second phase of the RCE focused on identification of the root and contributing causes using a structured analysis process. The root cause of the event was determined to be degradation of a coating system that was not designed for immersion service. Periodic exposure of the coating system to immersion conditions in the reactor pit area (-15'8" el.) caused accelerated degradation of the coating and corrosive attack of the underlying carbon steel liner plate. There were several contributing causes (described above) that included a number of programmatic issues. A review of the industry OE revealed this to be the first containment liner plate degradation event attributed to boric acid corrosion.

Corrective actions were developed to address the root and contributing causes. The root cause analysis for the Unit 3 condition revealed that Unit 4 has had similar issues. A through wall hole and reduced liner plate thickness were discovered November 25, 2006 in the reactor cavity sump.

The Corrective Action to Prevent Recurrence (CAPR) to address the root cause consists of the application of a coating system suitable for immersion service on the liner plate in the lower region of the reactor pit area (-15'8" el.) during the Unit 3 Cycle 26 Refueling Outage. To address the extent of condition, the same coating system will be applied to the same region of the Unit 4 liner plate during the Cycle 27 Refueling Outage.

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REPORTABILITY

The Unit 3 condition reported October 25, 2010 to the NRC (Event number 46362) is considered to be reportable under 10 CFR 50.73(a)(2)(ii)(A) [principal safety barrier being seriously degraded] as well as 10 CFR 50.73(a)(2)(i)(B) [condition prohibited by Technical Specifications.] Design Features Technical Specification 5.2.1f requires a nominal thickness of the containment steel liner of 0.25 inches.

ANALYSIS OF SAFETY SIGNIFICANCE

The 2010 Unit 3 event is considered reportable as a degraded condition of a principal safety barrier (i.e. containment being degraded due to existence of approximately seven square inches of through holes in the reactor building containment liner plate. The function of the liner plate is to provide a leak-tight barrier to the containment structure and to limit the leakage of radioactive material to the environment. The containment liner is classified as a safety related structure. In that area of the liner plate, the plate is backed by a minimum of five feet of concrete. If there were to be a release, it would have to wind its way through the concrete and out the containment. A vendor has been contracted to evaluate the magnitude of the potential increase in containment leakage and the associated radiological consequences. The evaluation is to be completed by the end of January in 2011. This LER may be supplemented depending on the results of this evaluation. The supplement would be made if needed within 30 days of the results of the evaluation being received. The current Turkey Point UFSAR Table 14.3.5-5 radiological results for the LOCA indicate margin to the limits, so it is not expected that the upper limit for leakage of radioactive materials to the environment will be exceeded, even if a Maximum Hypothetical Accident were to occur.

CORRECTIVE ACTIONS

Immediate Corrective Actions:

- Immediate corrective actions were taken to remove the degraded portion of the liner plate and welding a replacement plate, measuring about 4" x 32" in place. The weld was inspected per ASME XI code requirements and inspected (magnetic particle and visual) after the local leak rate test was performed.

Corrective Actions to Prevent Recurrence:

- The Corrective Action to Prevent Recurrence (CAPR) to address the root cause consists of the application of a coating system suitable for immersion service on the liner plate in the lower region of the reactor pit area (-15'8" el.) during the Unit 3 Cycle 26 Refueling Outage. To address extent of condition, the same coating system will be applied to the same region of the Unit 4 liner plate during the Cycle 27 Refueling Outage.

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Corrective Actions to Prevent Recurrence:

Contributing Cause Corrective Actions:

- Review need for replacement of cavity seal rings
- Modify procedure for draining the reactor cavity to alleviate flooding the reactor pit
- Revise Boric Acid Corrosion Control procedure to identify the upper reactor cavity as a potential source of borated water
- Revise ASME XI, IWE program to require that all visual inspectors have specific training and revise inspection data sheets
- Revise Appendix J Containment Building Visual Inspection procedure to include the reactor pit area

ADDITIONAL INFORMATION

EIIS Codes are shown in the format [IEEE system identifier, component function identifier, second component function identifier (if appropriate)].

FAILED COMPONENTS IDENTIFIED: Containment Liner

PREVIOUS SIMILAR EVENTS: No similar previous LERs